13.0 LEVEL 3 EVALUATION – DETAILED ANALYSIS

13.1 Alternative Corridor Revisions

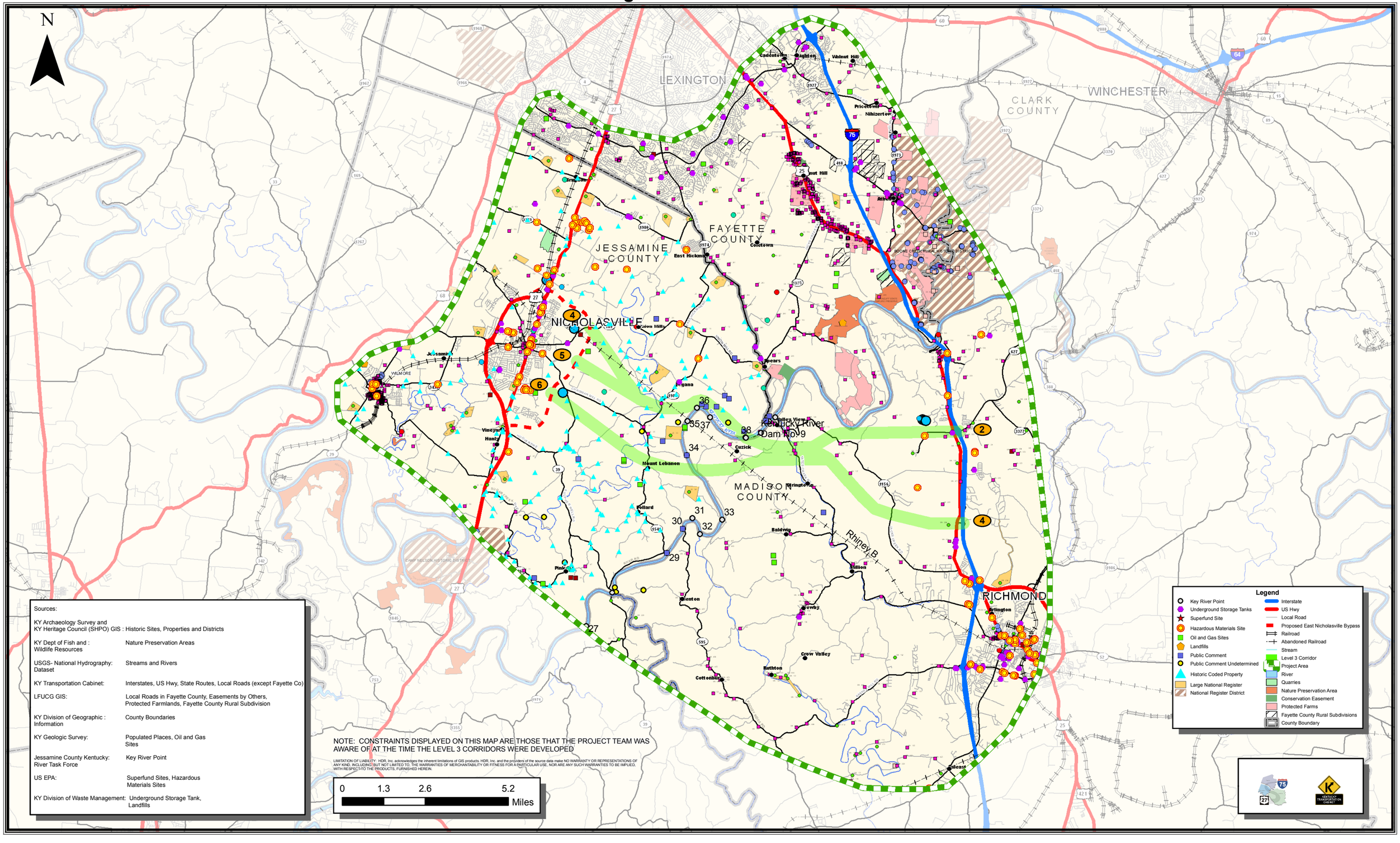
After the original eighteen corridors were narrowed down to six, the remaining corridors were adjusted slightly to minimize impacts to nationally registered historic sites, residential areas, to reduce the amount of earthwork that would need to be completed and to avoid the lock and dam on the Kentucky River. **Figure 16** shows the refined six remaining corridors.

13.2 2040 Alternative Corridor Traffic Forecasts

In the Level 2 Analysis, 2040 traffic volumes could not be calculated using historical growth rates because the corridor is a new roadway. However at that level of detail, the actual 2040 number was not as important as were the relative comparisons of traffic volumes amongst the different alternative corridors. Therefore a one percent per year growth rate was applied to each of the corridors. For the Level 3 Analysis, a more realistic growth rate must be applied so the corridor volumes could not only be comparable to one another, but also provide a more realistic idea of how much traffic would actually use the corridor. This is necessary so the PDT can be able to identify what type of facility and the number of lanes that would be needed, as well as determine if usage would justify the cost.

A meeting was held with project team members as well as several representatives from the KYTC Central Office Planning Division to discuss an appropriate method to determine the 2040 volumes for the new connector. PB was confident with the 2003 volumes obtained from the KYSTM, however the KYSTM is not able to forecast to future years. The Lexington MPO travel demand model is able to forecast to future years, however this model only includes Fayette and Jessamine counties. Because all six alternative corridors terminate in Madison County, the corridors could not be coded into the model and forecasted to a future year. The inability to find a growth rate for the corridors resulted in the decision to find an overall growth rate for the study area and apply it to the new connectors. This method posed additional problems, however, because many of the roadways in the study area have very high historical growth rates and cannot realistically continue to grow at those rates due to capacity constraints. The KYTC Central Office has developed a new “hybrid” growth rate that is a middle point between exponential and linear historical growth. This growth rate has not been widely used yet, but it is appropriate for this study because it constrains growth. It was decided that this growth rate would be used for roadways in Madison County, and that an average of the KYTC growth rate and the growth rates calculated based on the Lexington MPO travel model would be used to get a growth rate for roadways in Fayette and Jessamine counties. A weighted average of the growth rates of major roadways in the study area was calculated to provide an overall study area growth rate. This number was calculated to be 2.24% per year and was applied to each new connector to determine 2040 ADTs.

Figure 16: Level 3 Corridors



13.3 Typical Sections

Several types of facilities were considered for this project. Eventually, a four-lane facility may likely be desirable. However, depending on when a new connector is built, a two-lane facility may initially be adequate. If it is determined that this is the case, right-of-way for a four-lane facility could be bought, so that widening would be possible in the future. There has also been discussion of the need for a multi-use path to accommodate bicyclists and pedestrians. **Figures 17, 18, 19 and 20** shows four typical sections that could be used for the new connector. These include a two-lane facility with right-of-way for an eventual four-lane facility, a four-lane facility, a two-lane facility with right-of-way for a four-lane facility with the addition of a multi-use path along one side, and a four-lane facility with a multi-use path on one side.

Figure 17: Two-Lane Typical Section

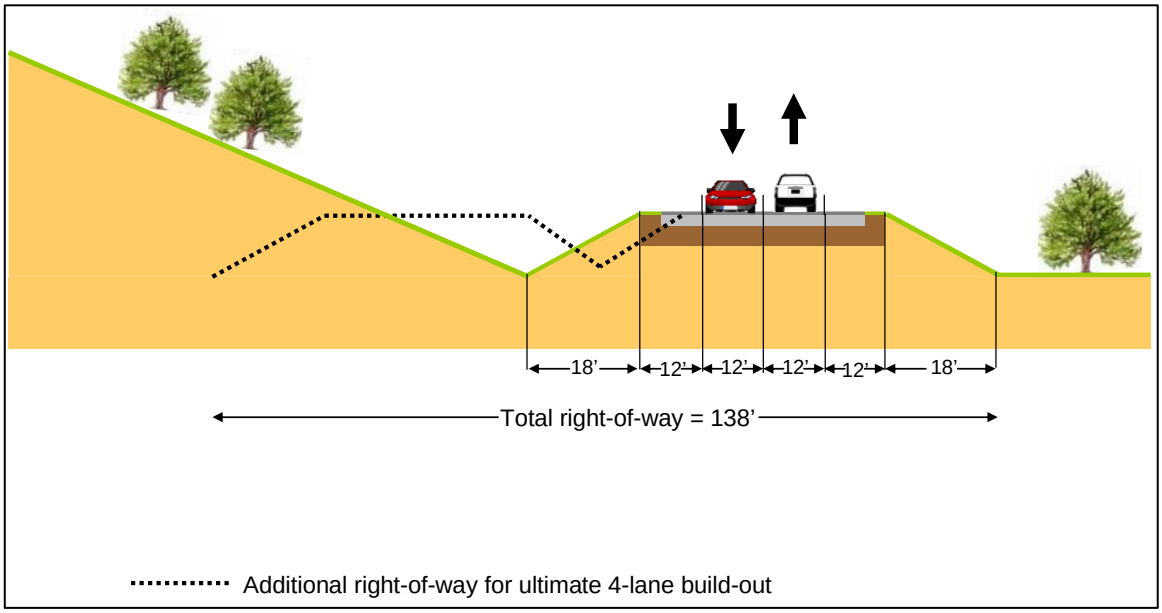


Figure 18: Four-Lane Typical Section

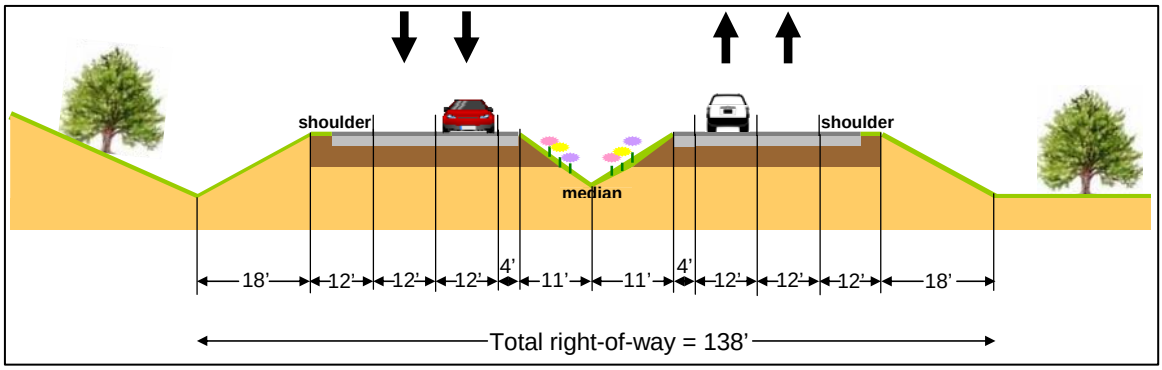


Figure 19: Two-Lane Typical Section with Multi-Use Path

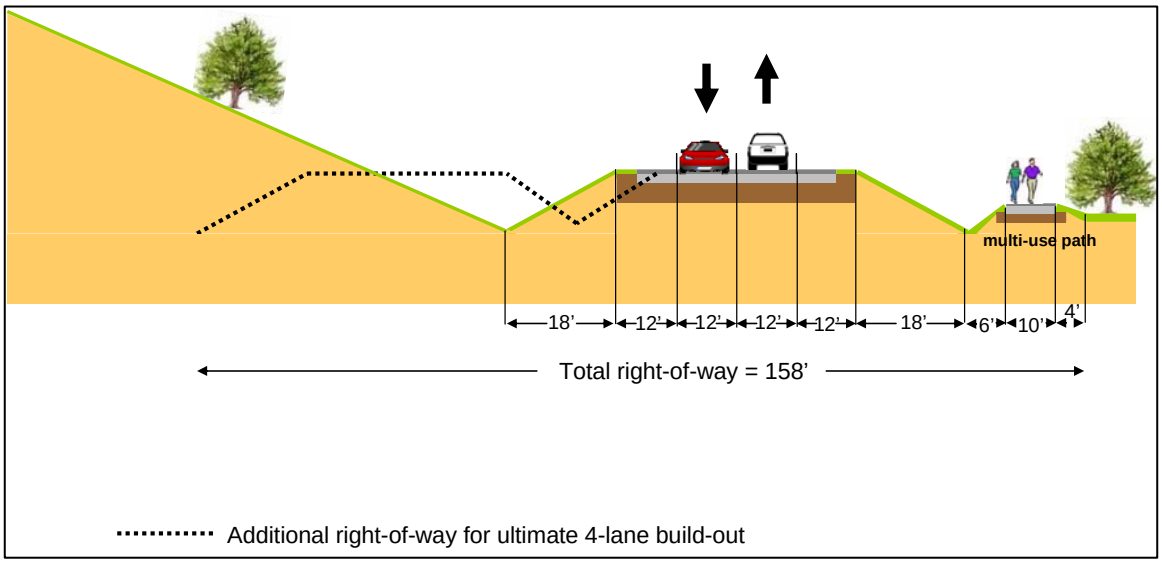
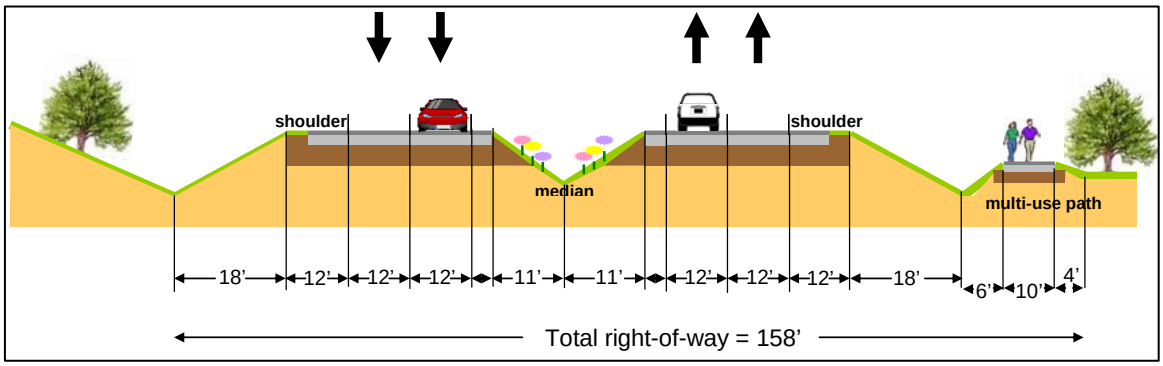


Figure 20: Four-Lane Typical Section with Multi-Use Path



To determine if a two-lane facility is appropriate for initial construction, capacity constraints of the roadway must be determined. According to the 2000 Highway Capacity Manual (HCM), two-lane roadways have a two-way capacity of 3,200 passenger cars per hour (pc/h). At capacity, the LOS is E, with operating conditions unpredictable. The level of service for a two-lane roadway is largely dependent on the percent time spent following. Therefore, as the traffic volume for both directions increases, or if there is a high percentage of no-passing zones, the level of service decreases. Because of the hilly terrain of the study area, as well as the large percentage of trucks that would use a potential connector, this roadway is likely to have a higher percent of time spent following than would a roadway of equal traffic volume with a less hilly terrain and lower truck percentage.

The Highway Capacity Software Plus (HCS Plus) software package was used to determine the year that a LOS E or below would be reached for this roadway. The

corridor volumes used for this analysis were based on the 2003 traffic volumes from the KYSTM, inflated by the study area growth rate of 2.24% per year. Based on the highway capacity analysis, a two-lane roadway will fail when the ADT for one segment reaches 13,970 vehicles. **Table 15** shows the year at which one segment of the two-lane roadway will reach that volume for each of the six alternatives.

Table 15: Year at which a Two-Lane Roadway Fails

Corridor	Failure Year
4-2	2015
4-4	2008
5-2	2017
5-4	2013
6-2	2022
6-4	2022

Based on this analysis, all of the corridors fail before the design year of 2040. Alternative corridors 6-2 and 6-4 would take the longest to reach failure, but failure occurs in the year 2022 which is still eighteen years prior to the design year.

13.4 Level 3 Evaluation Summary

The Level 3 Evaluation involved a more detailed analysis of the remaining six corridors and the no-build alternative, after minor adjustments were made. The more detailed evaluation included updating information on system operations, traffic operations, natural environment, human environment and cost.

System Operations
The remaining corridors were re-evaluated with respect to system safety improvements, study area travel time savings and connectivity.

Traffic Operations
The ADT of each corridor was revised based on the method described in Section 13.2. Using the new ADT volumes, HCS+ was used to determine the level of service in 2040 if the new connector is a two-lane unlimited access facility, a four-lane unlimited access facility or a four-lane limited access facility. HCS+ does not evaluate two-lane unlimited access facilities; however it will likely perform only slightly better than a two-lane unlimited access roadway, as level of service for two-lane facilities is largely impacted by passing ability. While a limited access roadway would eliminate delays due to intersections, it would not greatly improve passing ability and opportunity. Traffic operations along US 27, I-75 and Man O' War Boulevard were compared among each of the alternatives using ADTs from the KYSTM. A range of LOS for various segments along US 27, I-75, Man O' War Boulevard was given for the no-build as well as each of the six corridor scenarios. Each new corridor's truck percentage was also calculated.

Natural Environment
The number of streams impacted in the corridor, potential wetlands / ponds in the corridors and floodplain impacts were all re-evaluated for the adjusted corridors.

Human Environment
The number of known historic and archeological sites in the corridor, environmental justice impacts, farmland impacts and landfills and other potential HAZMAT site impacts were all re-evaluated for the adjusted corridors.

Cost
Right-of-way and utilities costs were estimated in 2008 dollars for each corridor. Cost estimates were derived for base two-lane and four-lane roadways for each corridor. Costs were also calculated to add a 10-foot multi-use path to each corridor, as well as to add two interchanges to make each corridor limited access. Total costs were estimated for two and four-lane roadways with at-grade intersections, with at-grade intersections and a multi-use path, limited access roadways with no multi-use path, and limited access roadways with a multi-use path.

13.5 Level 3 Corridor Analysis

The remaining six corridors were put into an evaluation matrix (using the previously described evaluation criteria) along with the no-build scenario. **Table 16** shows the evaluation matrix.

No-Build

The no-build alternative does not significantly improve system safety or provide any travel time savings, nor does it have any connectivity. Traffic volumes along US 27, I-75 and Man O' War Boulevard are higher than what the roadways can accommodate along most sections. Connector ADT, LOS and truck percentage cannot be calculated because there is no connector in this scenario. This alternative has no impacts to the human or natural environment and has no costs associated with it beyond those that are anticipated from the individual Existing and Committed projects.

Table 16: Level 3 Evaluation Matrix

Alternative Corridors	System Operations					Traffic Operations								
	Length	System Safety Improvement (Low, Medium, High)	Study Area Travel Time Savings (vehicle hours of travel)	Connectivity		2040 Average Daily Traffic (Low to High)				2040 Connector Level of Service (range)				Corridor Truck % (range)
				US 27 (West)	I-75 (East)	Connector	US 27	I-75	Man O' War Blvd	2 Lane Unlimited Access	2 Lane Limited Access	4 Lane Unlimited Access	4 Lane Limited Access	
0	0.00	**Low**	**0**	**None**	**None**	N/A	13,800 - 146,700	114,100 - 192,400	51,300 - 135,900	N/A	N/A	N/A	N/A	N/A
4-2	12.92	Medium	**482**	**KY 169**	**KY 3055, KY 627**	20,000 - 24,000	8% less to 12% more	9% less to 2% more	9% less to no change	E-F	-	B	B	14.8% - 16.2%
4-4	13.72	Medium	395	KY 169	None	**23,000 - 28,000**	7% less to 12% more	11% less to 3% more	9% less to no change	E-F	-	B-C	B-C	10.9% - 13.3%
5-2	12.83	Medium	368	None	KY 3055, KY 627	20,000 - 23,000	9% less to 21% more	8% less to 1% more	9% less to no change	E	-	B	B	14.7% - 15.85
5-4	13.67	Medium	271	**None**	**None**	21,000 - 25,000	11% less to 21% more	9% less to 3% more	9% less to no change	E-F	-	B	B	12.5% - 13.9%
6-2	13.29	**Low**	276	None	KY 3055, KY 627	**18,000 - 20,000**	9% less to 21% more	8% less to 2% more	9% less to no change	E	-	B	B	15.8% - 16.8%
6-4	14.07	**Low**	**134**	**None**	**None**	**17,000 - 21,000**	10% less to 21% more	9% less to 3% more	10% less to no change	E	-	B	B	14.1% - 15.4%

Table 16: Level 3 Evaluation Matrix (cont.)

Alternative Corridors	Natural Environment			Human Environment				
	No. of Streams Impacted in Corridor	Potential Wetlands / Ponds in Corridor #'s (Acres)	Floodplains Impacts (Acres)	No. of Known Historic Sites in Corridor	No. of Known Archeological Sites in Corridor	Environmental Justice Impacts	Farmland Impacts (Acres)	Landfills and Other Potential HAZMAT Site Impacts
0	**0**	0(0)	**0**	**0**	**0**	**None**	**0**	**0**
4-2	25	44(45)	**81**	**17**	**2**	**Low-income impacts**	645	**4**
4-4	25	52(39)	**81**	**17**	**1**	**Low-income impacts**	759	**0**
5-2	23	48(47)	72	15	**2**	**None**	654	**4**
5-4	**20**	54(41)	72	15	**1**	**None**	**769**	**0**
6-2	**27**	59(61)	**59**	6	**4**	**None**	**586**	**4**
6-4	22	59(54)	**59**	**4**	3	**None**	688	**0**

Table 16: Level 3 Evaluation Matrix (cont.)

Alternative Corridors	Cost (in 2008 Dollars)					
	Right-of-Way Cost	Utilities Cost	Design and Construction Cost			
			2-Lane (base estimate)	4-Lane (base estimate)	Additional Cost for 10' Multi-use Path	Additional Cost for Limited Access
0	**0**	**0**	**0**	**0**	**0**	**0**
4-2	$13,000,000	**$3,000,000**	$169,000,000	$300,000,000	$23,000,000	$41,000,000
4-4	**$14,000,000**	**$3,000,000**	$175,000,000	$314,000,000	**$25,000,000**	$41,000,000
5-2	**$10,000,000**	**$3,000,000**	**$168,000,000**	$297,000,000	$23,000,000	$41,000,000
5-4	$12,000,000	**$3,000,000**	$175,000,000	$311,000,000	$24,000,000	$41,000,000
6-2	**$10,000,000**	**$4,000,000**	$172,000,000	**$287,000,000**	**$22,000,000**	$41,000,000
6-4	$11,000,000	**$4,000,000**	**$178,000,000**	**$318,000,000**	**$25,000,000**	$41,000,000

Table 16: Level 3 Evaluation Matrix (cont.)

Alternative Corridors	Total Cost (in 2008 Dollars) Does Not Include Mitigation Costs							
	2-Lane, at-grade	2-Lane, at-grade, 10' Path	2-Lane, Limited Access	2-Lane, Limited Access, 10' Path	4-Lane, at-grade	4-Lane, at-grade, 10' Path	4-Lane, Limited Access	4-Lane, Limited Access, 10' Path
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
4-2	$185,000,000	$208,000,000	$226,000,000	$249,000,000	$316,000,000	$339,000,000	$357,000,000	$380,000,000
4-4	$192,000,000	$217,000,000	$233,000,000	$258,000,000	$331,000,000	$356,000,000	$372,000,000	$397,000,000
5-2	**$181,000,000**	**$204,000,000**	**$222,000,000**	**$245,000,000**	$310,000,000	$333,000,000	$351,000,000	$374,000,000
5-4	$190,000,000	$214,000,000	$231,000,000	$255,000,000	$326,000,000	$350,000,000	$367,000,000	$391,000,000
6-2	$186,000,000	$208,000,000	$227,000,000	$249,000,000	**$301,000,000**	**$323,000,000**	**$342,000,000**	**$364,000,000**
6-4	**$193,000,000**	**$218,000,000**	**$234,000,000**	**$259,000,000**	**$333,000,000**	**$358,000,000**	**$374,000,000**	**$399,000,000**

Corridor 4-2

Corridor 4-2 has a length of approximately 13 miles, and provides medium system safety improvements. It provides the highest study area travel time savings of all of the corridors, and the best connectivity, connecting to KY 169 in the west and KY 3055 and KY 627 in the east. It has an ADT between 20,000 and 24,000, and provides a LOS E-F in 2040 for a two-lane unlimited access road and a LOS B for a four-lane limited or unlimited access roadway. The addition of the corridor would lower traffic volumes on some segments of Man O' War Boulevard, but there is no change in LOS for US 27, Man O' War Boulevard and I-75. This corridor has the most impacts to floodplains, known historic sites and landfills and other potential HAZMAT sites. There is also the potential for impacts to low-income populations. Cost estimates for this alternative range from $185 to $381 million dollars, depending on the type of facility.

Corridor 4-4

Corridor 4-4 is approximately 14 miles long and connects to KY 169 at the western terminus. It has medium system safety improvements and the second highest study area travel time savings. It has the highest ADT of all of the alternatives, ranging from 23,000 to 28,000 vehicles per day. It provides a LOS E-F for a two-lane unlimited access facility and LOS B-C for a four-lane limited or unlimited access roadway. The corridor does lower traffic volumes on some segments of Man O' War Boulevard, however there is no change in LOS on US 27, Man O' War Boulevard or I-75. In addition, this alternative also has the most impacts to floodplains and known historic sites. There is the potential for impact to low-income populations. This corridor has the highest right-of-way costs, with total cost estimates ranging from $192 to $397 million dollars.

Corridor 5-2

Corridor 5-2 is approximately 13 miles long, has medium system safety improvements and the third highest study area travel time savings. This corridor connects to KY 3055 and KY 627 at the eastern terminus. It has an ADT of 20,000 to 23,000 vehicles and provides a LOS E for a two-lane unlimited access road and LOS B for four-lane limited and unlimited access roads. This corridor lowers traffic volumes on some segments of Man O' War Boulevard, but there is no change in LOS for US 27, Man O' War Boulevard and I-75. This corridor has the highest number of landfill and other potential HAZMAT site impacts, but no environmental justice impacts. The cost estimates for this alternative range from $181 to $374 million dollars, which are the lowest costs for the two-lane alternatives.

Corridor 5-4

Corridor 5-4 is approximately 14 miles long and has medium system safety improvements and average travel time savings. It has no connectivity at either terminus. The ADT is between 21,000 and 25,000 vehicles per day, and the LOS is E to F for a two-lane unlimited access road and B for a four-lane limited or unlimited access road. The corridor lowers traffic volumes on some segments of Man O' War Boulevard, but there is no change in LOS on US 27, Man O' War Boulevard or I-75. This alternative impacts the lowest number of streams, known archeological sites, and

landfills and other potential HAZMAT sites. The cost estimates for this alternative range from $189 to $391 million dollars.

Corridor 6-2

Corridor 6-2 is approximately 13 miles long, has low system safety improvements and average travel time savings. It connects to KY 3055 and KY 627 at the eastern terminus. It has one of the lowest ADTs of all the alternatives, ranging from 18,000 to 20,000 vehicles. It has LOS E for a two-lane unlimited access roadway and LOS B for a four-lane limited or unlimited access roadway. The addition of the corridor results in lower traffic volumes on some segments of Man O' War Boulevard, but no change in LOS for US 27, Man O' War Boulevard and I-75. This alternative impacts the highest number of streams, potential wetlands / ponds, known archeological sites, and landfills and other potential HAZMAT sites. However, it impacts the lowest amount of floodplains and farmland, and has no environmental justice impacts. The corridor has the highest utilities costs but the lowest overall costs for the four-lane roadway scenarios. The cost estimates range from $185 to $363 million dollars.

Corridor 6-4

Corridor 6-4 is the longest remaining corridor at approximately 14 miles. It has low system safety improvements and the lowest study area travel time savings. It has no connectivity and one of the lowest ADTs with 17,000 to 21,000 vehicles per day. It has LOS E for a two-lane unlimited access roadway and LOS B for a four-lane limited or unlimited access road. The corridor does lower traffic volumes on some segments of Man O' War Boulevard, but there is no change in LOS for US 27, Man O' War Boulevard and I-75. It has one of the highest impacts to potential wetlands / ponds, but the lowest impacts to floodplains, known historic sites, and landfills and other potential HAZMAT sites. There are no environmental justice impacts. This alternative has the highest utilities cost and overall roadway costs, regardless of scenario. Estimates range from $193 to $399 million dollars.